


Received: 12 December 2016 | Revised: 23 June 2017 | Accepted: 19 October 2017

DOI: 10.1111/conl.12422

LETTER

WILEY Conservation Letters
A Journal of the Society for Conservation Biology 

Social fit of coral reef governance varies among individuals

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Abstract

Improved natural resource governance is critical for the effective conservation of ecosystems, and the well-being of societies that depend on them. Understanding the social fit of institutional arrangements in different contexts can help guide the design of effective environmental governance. This empirical study assessed individual-level variation in institutional acceptance of coral reef governance among 652 respondents in 12 fishing and tourism-oriented communities in the Wider Caribbean. High institutional acceptance was strongly associated with perceptions of community cohesiveness, underlining the potential contribution of civil society to effective governance processes. Institutional acceptance was also influenced by reef use, awareness of rules, perceived trends in reef fish populations, education, and contextual community-level factors. Understanding what influences diverse perceptions of coral reef governance among individuals can help to assess the likelihood of support for conservation measures. This study highlights how knowledge of institutional acceptance can inform the design of more targeted interventions that enhance the social fit of conservation governance to local contexts and diverse resource users.

KEYWORDS

Caribbean, community perceptions, institutional fit, natural resource management, social acceptance

1 | INTRODUCTION

Effective governance of natural resources is critical for the conservation of biodiverse ecosystems such as coral reefs, and the well-being of dependent communities (Hughes, Graham, Jackson, Mumby, & Steneck, 2010). Governance of environmental problems is challenging, as decisions that reconfigure human-environment relationships often have profound social implications, and those involved have diverse values, interests, and preferred solutions (Song, Chuenpagdee, & Jentoft, 2013). Increasingly, research explores how environmental governance can be enhanced by improving the “fit” of institutional arrangements. The concept of institutional fit refers to the degree to which governance systems match the scale and dynamics of their ecological and social con-

texts, and associated challenges (Galaz, Olsson, Hahn, Folke, & Svedin, 2008). Though the problem of ecological fit is well recognized, social fit is comparatively under-researched. Social fit describes the congruence between institutions and the attributes of social systems, with greater fit expected to enhance governance performance in delivering desired outcomes (Epstein et al., 2015). Social fit can be influenced by the congruence between formal governance networks and local social patterns (Meek, 2013), the alignment of rules with characteristics of the social system (Cinner, 2007), and the appropriateness of decision-making processes in relation to stakeholder preferences and expectations (DeCaro & Stokes, 2013).

Environmental governance comprises interactions among a range of actors in society (Kooiman, Bavinck, Jentoft, &

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Pullin, 2005). Understanding how resource users perceive the quality of these interactions can indicate institutional acceptance, an important component of social fit that describes the social acceptability of governance arrangements (DeCaro & Stokes, 2013). Knowledge of how institutional acceptance is socially differentiated can contribute to understanding diversity in resource user behavior and responses to management. Coastal communities have an important stake in coral reef governance, particularly where conservation outcomes impact resource-dependent livelihoods (McClanahan et al., 2009). Stakeholder perceptions of governance interactions have important implications for conservation practice and governance outcomes because they can influence resource use behavior, engagement in decision-making, and support for management (Gelcich et al., 2009; Hoelting, Hard, Christie, & Pollnac, 2013). Governance weaknesses such as low trust, lack of legitimacy, inequity or limited inclusiveness can contribute to reduced support for management, non-compliance with rules, or poor management performance (Horigue, Fabinyi, Pressey, Foale, & Aliño, 2016; Velez, Adlerstein, & Wondolleck, 2014).

Though there is no panacea for achieving institutional fit, understanding how community members perceive institutional arrangements can inform the design of effective coral reef governance. A number of studies have drawn on Ostrom's (1990) institutional design principles to identify how different structural configurations of governance contribute to social and environmental outcomes (Cinner & Huchery, 2014; MacNeil, & Cinner, 2013). However, communities encompass diverse people and incentives, and within any given set of governance arrangements perceptions may be differentiated according to demographics, resource use patterns, socioeconomic characteristics, cultural factors, and individual experiences or preferences (Dalton, Forrester, & Pollnac, 2012). While studies have explored how preferences for management measures and their perceived benefits may be socially differentiated (McClanahan et al., 2009), few explore differences in institutional acceptance within, or between, multiple contexts. This intermediate link is important, because positive perceptions of governance may enhance support for or compliance with rules even where they do not confer positive outcomes for the individual.

This study explores whether there are common factors that help explain variation in institutional acceptance among individuals in 12 coral reef-dependent communities across four Caribbean countries. Institutional acceptance has been found to vary among these sites, and was associated with differences in institutional design at community level (Turner et al., 2014). However, the diversity of individual perceptions within these communities remains poorly understood. This article explores social differentiation in institutional acceptance by investigating the influence of individual-level factors. Specific objectives were to: (1) identify factors associated with

individual-level variation in institutional acceptance and (2) assess the relative importance of individual factors and context (country and community) in explaining variation in perceptions. Insights from this study can contribute to identifying appropriate and targeted interventions for improved social fit of coral reef governance.

2 | METHODS

2.1 | Study sites

Calls for improved governance of Caribbean coral reefs stem from failures to halt well-documented ecological declines, combined with future threats such as population pressure and climate change (Jackson, Donovan, Cramer, & Lam, 2014). Four countries, Barbados, St Kitts and Nevis, Belize, and Honduras, were selected to reflect the diverse socioeconomic conditions, marine resource dependency, and environmental governance arrangements across the Wider Caribbean (Table 1). Within each country, three surveyed communities captured differences in reef use, and data were collected to characterize community-level socioeconomic and governance characteristics (Table 2). This study builds on work by Turner et al., 2014 that evaluated the influence of these characteristics on institutional acceptance at community level.

2.2 | Data collection

Perceptions of reef governance were assessed using semistructured interviews ($n = 871$) undertaken between February 2011 and August 2012. In each community up to 50 direct reef resource users (depending on the total number present), and a minimum of 25 community members were sampled. Direct resource users (reef fishers and reef-related tourism operators) were targeted through opportunistic and snowball sampling as their small proportion within communities made their selection unlikely in a random sample. Remaining respondents were sampled from households within community boundaries, using 100 m x 100 m numbered grids and a random number list.

Institutional acceptance was measured using a multivariate index ($\alpha = 0.72$), derived from responses to five questions about coral reef governance (Table S1). Questions were based on a framework of good governance principles, which provide a normative basis to guide governance interactions (Kooiman et al., 2005). Full details of analyses underpinning the index can be found in Turner et al., 2014.

Individual and household characteristics were based on a literature review that identified factors influencing perceptions of a range of aspects of marine resource governance and management, including: governance processes (e.g., perceived legitimacy, participation in decision-making); management preferences; and perceptions of governance

TABLE 1 Characteristics of study countries and their coral reef governance arrangements

Country	Location	State type	GNI per capita 2011 PPP \$ ^a	Reef area (km ²) ^b	Marine protected areas ^c	Main state actors in coral reef governance ^d	Civil society involvement in coral reef governance ^d
Barbados	Eastern Caribbean	Island	12,488	90	1	National government	Few local-level groups or resource user organizations
St Kitts and Nevis	Eastern Caribbean	Two-island federation	20,805	160	1	National government and island-level administration	Few local-level groups or resource user organizations
Belize	Western Caribbean	Continental	7,614	1,420	19	National government, town and village councils	Strong involvement of NGOs and resource user organizations (e.g., cooperatives, tour guide associations)
Honduras (Bay Islands)	Western Caribbean	Continental	3,938	1,120	18	National and municipal government, town and village councils	Strong involvement of NGOs and some resource user organizations

^aUNDP, 2015. Human Development Report 2015. United Nations Development Program.

^bBurke, L., Maidens, J., 2004. Reefs at Risk in the Caribbean. World Resources Institute, Washington, DC.

^cWood, L.J., 2007. MPA Global: A database of the world's marine protected areas. Sea Around Us Project, UNEP-WCMC & WWF.

^dBased on data collection in-country.

outcomes or livelihood benefits. Five key themes were represented (Table 3). Qualitative explanations of all responses were recorded to aid interpretation.

2.3 | Data analysis

Linear mixed effect models were used to investigate individual-level factors affecting institutional acceptance. A progressive model-building strategy was used to determine the most parsimonious model (Pinheiro & Bates, 2000). The initial model was fitted with random effects for community nested within country. This mirrored the data structure and reflected prior analysis that identified differences in perceptions among countries and communities, in part, because of contextual differences in governance arrangements (Turner et al., 2014). For model simplicity, community-level variables were not included, but were subsequently explored in relation to model residuals and random effect coefficients. A limitation may be that this does not capture possible interactions between the institutional design in each site and individual-level factors that influence perceptions (MacNeil & Cinner, 2013).

Due to the large number of possible explanatory variables, a stepwise forward selection process was used to select fixed effects (Table 1). Models were fitted using restricted maximum likelihood (REML) in the nlme package (Pinheiro, Bates, DebRoy, Sarkar, 2013) in R (R Core Team 2016).

Model assumptions were checked by examining model residuals. Of 871 respondents, 8 did not respond to questions about institutional acceptance, therefore 863 were included in the analysis. Due to missing data in covariates, the most parsimonious model used 652 records.

The proportion of variance explained by this model was estimated using the MuMIn package (Barton, 2015) to calculate: (1) the marginal variance (proportion of variance explained by fixed (individual level) factors alone) and (2) the conditional variance (the proportion of variance explained by both fixed and random [country and community level] factors). Together, these indicate the explanatory power of the model and the relative importance of individual factors versus context.

Once appropriate individual covariates had been fitted, the relative importance of country and community context in explaining individual perceptions was assessed by comparing the model with nested random intercepts to models with random intercepts for either country or community alone. Models were fitted with maximum likelihood and compared using ANOVA.

3 | RESULTS

The final model revealed that all five themes of individual characteristics (Table 3) were important influences on

TABLE 2 Characteristics of reef use and coral reef governance arrangements in the 12 communities studied

Country	Community	Primary reef use	Estimated commercial fishers	Number of SCUBA dive shops	GO	NGO	Resource user organization	Access to information	Degree of comanagement
Barbados	Pile Bay	Fishing	27	4	No	No	Yes	High	Consultative
	Six Men's	Mixed	40	1	No	No	No	Medium	Consultative
	Holetown	Tourism	24	2	Yes	No	No	High	Consultative
Belize	Hopkins	Fishing	75	2	No	No	Yes	Low	Collaborative
	Placencia	Mixed	48	5	No	Yes	Yes	High	Delegated
	San Pedro	Tourism	15	18	Yes	Yes	Yes	High	Collaborative
Honduras (Bay Islands)	Utila Cays	Fishing	65	0	No	No	No	Low	Delegated
	East Harbor	Mixed	19	13	Yes	Yes	No	Medium	Delegated
	West End	Tourism	15	13	No	Yes	Yes	High	Delegated
St Kitts and Nevis	Dieppe Bay	Fishing	50	0	No	No	No	Low	Consultative
	Jessups	Mixed	33	1	No	No	No	Low	Consultative
	Newtown	Tourism	55	4	Yes	No	No	Medium	Consultative

Notes: Estimated number of commercial fishers (those who sell part or all of their catch) are based on local scoping and key informant interviews; number of SCUBA dive shops includes those within or nearby the site that use the nearby coral reefs adjacent to the community. GO = governmental organization present in community; NGO = nongovernmental organization present in community; access to information is based on reported information-sharing relationships between community-level actors and outside organizations or departments; degree of comanagement based on typology outlined by Pomeroy *et al.* (2004) whereby consultative = government interacts with stakeholders but often makes decisions, collaborative = government and stakeholders jointly make decisions, and delegated = government lets formally organized stakeholders make decisions.

institutional acceptance (Table 4). Approximately 15% of the variation in institutional acceptance was explained by these individual characteristics (marginal $R^2 = 0.149$).

Covariates relating to social cohesion (community cooperation and acceptance in the community) had the largest effect sizes (Table 4). Respondents who perceived that community members worked together to solve problems had higher institutional acceptance than those who did not. Similarly, respondents who felt accepted as part of the community displayed higher institutional acceptance. Respondents who used reefs for either fishing or tourism showed higher institutional acceptance than those who did not. Perception of a decline in reef fish over the past 10 years had a negative effect on institutional acceptance, as did higher education levels. In contrast, respondents who were aware of rules in place to manage reef use had more positive perceptions of governance than those unaware of rules.

No statistically significant association with institutional acceptance was found for respondent age, material style of life, number of household occupations, perceived decline in coral reefs, perceptions of current reef and reef fish health, or perceived locus of responsibility for coral reefs.

Approximately 10% of variation in institutional acceptance was explained by random effects, i.e., community and country. Comparison of models with different random effects structures revealed that nested random effects led to a statistical improvement compared to a model with no random effects

(LR = 28.75, $P < 0.01$) or random intercepts for country only (LR = 12.15, $P = 0.001$), and was equivalent to a model with random intercepts for community only (LR = 1.36, $P = 1.000$). These findings suggest that, following selection of appropriate individual-level covariates, the variability explained by the random effects was predominantly related to community characteristics. Examination of model residuals and random effect coefficients suggested that community-level differences in governance structure were not associated with model residuals (Figure S1) and were adequately captured by random effects (Figure S2).

4 | DISCUSSION

Calls for innovation in institutional thinking suggest that institutions should be conceptualized more broadly to encompass normative and sociocultural as well as regulatory dimensions (Chuenpagdee & Song, 2012). By using a measure of institutional acceptance based on good governance principles to provide insights into institutional fit, this study contributes to a growing body of literature that incorporates these dimensions (Song *et al.*, 2013; Horigue *et al.*, 2016). Findings presented demonstrate heterogeneity in institutional acceptance, indicating that social fit varies among individuals even within the same governance arrangements. In conjunction with literature establishing the importance of institutional design

TABLE 3 Covariate characteristics of individual respondents and their household, categorized under five themes

Covariate	Description	Data type
<i>Demographics: Demographic factors may influence individual capacity to take advantage of opportunities to engage with governance, for example, through elite capture of decision-making (McClanahan et al., 2009; Pita et al. 2013).</i>		
Age	Age of respondent (years)	Interval
Education	Level of education (primary, secondary, higher/professional)	Ordinal
Wealth	Material style of life index (derived from principal component analysis of 14 household assets and attributes)	Continuous
<i>Reef dependence: Management preferences and perceived positive outcomes have been found to vary among different occupational groups and levels of livelihood dependency on natural resource use (Gelcich et al., 2009; Hoelting et al. 2013).</i>		
Reef use	Involvement in reef-related activities (fishing, tourism, both, neither)	Nominal
Occupations	Number of occupations within household	Interval
<i>Perceived environmental change: Perceptions of governance outcomes may be influenced by individual observations of environmental change (Velez et al. 2014).</i>		
Decline in coral reef	Perceived decline in coral reef health over the past 10 years (yes/no)	Binary
Decline in reef fish	Perceived decline in reef fish resources over the past 10 years (yes/no)	Binary
Current reef health	Perception of current state of reef health (very unhealthy, unhealthy, in-between, healthy, very healthy)	Ordinal
Current reef fish health	Perception of current state of reef fish resources (very few, few, in-between, many, very many)	Ordinal
<i>Social cohesion: Differing perceptions of social cohesion within communities can influence views on natural resource management and perceived benefits (Diedrich, 2007).</i>		
Sense of community	Community works together to solve problems (yes/no)	Binary
Acceptance	Respondent feels accepted as part of the community (yes/no)	Binary
<i>Awareness of management: Awareness of existing management and perceptions about who is responsible for a problem can influence individual engagement in governance interactions (Zanetell, & Knuth, 2004).</i>		
Locus of responsibility for reefs	Perceived responsibility for reefs lies with: (1) the government, NGOs or scientists (formal) (2) resource users, the community, or “everyone” (societal)	Binary ^a
Awareness of rules	Aware of rules relating to use of local reefs (yes/no)	Binary

^aThese responses were not mutually exclusive and were included as two binary variables.

and broader sociopolitical context in influencing governance social outcomes, findings highlight interplay between individual characteristics and contextual factors that influences social fit of coral reef governance.

4.1 | Factors influencing institutional acceptance

The importance of broader social structures in achieving social fit of coral reef governance is highlighted. Of the five themes considered, individual perceptions of social cohesion were most strongly associated with institutional acceptance. Respondents discussed experience of community cooperation to address problems, including disaster response, crime, and supporting community members. Consistent with other studies, prior experience of cooperative action may encourage positive perceptions of problem-solving processes relating to coral reefs. For example, participation in Caribbean marine protected area management has been attributed to prior involvement in deliberative processes (Dalton et al., 2012), and perceived existing “sense of community” influenced

Venezuelan resource users’ willingness to participate in management initiatives (Zanetell & Knuth, 2004). Findings are consistent with a wealth of literature emphasizing the importance of social capital for facilitating cooperation, building trust, encouraging collective action and equitable distribution of benefits (Pretty, 2003; Diedrich, 2007). Furthermore, respondents who did not feel accepted in the community showed lower institutional acceptance, consistent with literature suggesting marginalization of individuals to cause disillusionment and erode legitimacy. For instance, poor communication or alienation from decision-making may lead to resentment of authority or lack of support for management measures (Dimech, Darmanin, Philip Smith, Kaiser, & Schembri, 2009; Pita, Theodossiou, & Pierce, 2013).

Results agree with previous findings that perceptions of management measures differ among stakeholders (Dimech et al., 2009; Hoelting et al., 2013). However, in contrast to studies that commonly identify fishers as holding negative perceptions of conservation measures (Jones, 2008; Hoelting et al. 2013), higher institutional acceptance among all resource users was observed. Legitimacy is a key component

TABLE 4 Parsimonious linear mixed effects model investigating institutional acceptance in relation to covariates

Random effects		Intercept	Residual	Groups			
SD (intercept for country)		0.132		4			
SD (intercept for community)		0.122	0.500	12			
Fixed effects							
Theme	Covariate	Category	Value	SE	df	<i>t</i> value	<i>P</i> value
(Intercept)		−0.416	0.115	629	−3.619	<0.001	
Demographics	Education	–	−0.119	0.039	629	−3.032	0.003
Reef dependence	Reef use	Fishing and tourism	0.119	0.065	629	1.841	0.066
		Fishing	0.187	0.053	629	3.532	<0.001
		Tourism	0.147	0.064	629	2.308	0.021
Perceived environmental change	Perceived decline in fish	Yes	−0.145	0.044	629	−3.308	0.001
Social cohesion	Community cooperation	Sometimes/unsure	0.158	0.078	629	2.025	0.043
		Yes	0.288	0.044	629	6.552	<0.001
		Accepted in community	Sometimes/unsure	0.280	0.148	629	1.891
		Yes	0.193	0.075	629	2.578	0.010
Awareness of management	Aware of rules	Yes	0.124	0.050	629	2.466	0.014

Notes: Model fitted by REML using 652 observations (58% to 93% of records in each community), log likelihood = −501.495. Marginal $R^2 = 0.149$, conditional $R^2 = 0.247$. Fixed effects for categorical variables are reported in comparison to responses of “none” or “no.”

of institutional acceptance and helps explain these findings. Governing institutions can gain legitimacy through active engagement and by producing and communicating outcomes to demonstrate effectiveness (Lockwood, 2010). While certain institutional arrangements may be more effective in achieving this than others, within any particular governance system some individuals may also be more engaged than others. One explanation for greater institutional acceptance among resource users is that governing institutions may make greater efforts to engage individuals who directly use coral reefs. The positive effect of awareness of rules and negative effect of a perceived decline in reef fish may also be associated with legitimacy. Individuals who are aware of management activities may be more likely to perceive governing institutions as committed to protecting the resource. In contrast, those who observed a decline in resources may perceive management to be failing and be less inclined to consider governing authorities legitimate.

Findings related to the role of individual educational attainment contradict previous studies. Higher education levels are commonly associated with positive perceptions of natural resource management measures (McClanahan, Abunge, & Cinner, 2012; Pita et al., 2013), often attributed to greater understanding of conservation's importance (Kideghesho, Røskaft, & Kaltenborn, 2006). More broadly, education is expected to engender trust through increased knowledge of governance systems and their operation (Christensen & Læg Reid, 2005). In contrast, here, higher education was associated with lower institutional acceptance. One explanation for this is that education may equip individuals to be more critical of governance quality. Political science literature sim-

ilarly identified declining trust in government and political institutions among “critical citizens” with higher education in industrial democracies (Dalton, 2007).

Several characteristics not strongly associated with institutional acceptance, including age, material style of life, and number of household occupations, have been previously associated with heterogeneous perceptions of governance outcomes (MacNeil & Cinner, 2013; McClanahan et al., 2009). The effects of variables such as wealth can interact with other variables at multiple scales (MacNeil & Cinner, 2013), so it is possible that the model used here was unable to capture this complexity. Alternatively, findings may indicate that factors explaining institutional acceptance differ from those explaining perceived benefits. Individuals may be satisfied with governance processes without perceiving direct benefits, or vice versa. This has important implications for understanding social fit, as both variables may influence resource users' response to management measures.

Comparison of model structures suggested that community differences were more important than country-level variation. This is consistent with prior research demonstrating variation in perceptions of governance in these communities, in relation to their governance characteristics (Turner et al., 2014). However, it is difficult to disentangle the relative importance of individual and community characteristics, as the most important individual-level explanatory variables related to perceived community cohesion. A large proportion of variation in the data remained unexplained by the model, perhaps unsurprisingly given the diversity of contexts from which the sample was drawn, the intangible nature of governance principles measured, and the representation of contextual

differences in the model only by random effects for site and country. Nevertheless, the study confirms that both individual and contextual variables significantly influence institutional acceptance of coral reef governance.

4.2 | Management implications

Positive governance interactions that meet the psychological needs of stakeholders are likely to enhance institutional acceptance and thus improve the social fit of institutional arrangements to complex systems in which actors hold diverse views and values. Greater social fit can help reduce conflict and facilitate deliberation, prompt concern about environmental issues, increase support for management measures, and encourage involvement in management activities (Gelcich, Kaiser, Castilla, & Edwards-Jones, 2008; Hoelting et al., 2013; Velez et al., 2014). Social fit may therefore support the implementation of tools such as ecosystem-based management (Gelcich et al., 2009), marine protected areas (Pollnac et al., 2010), and marine spatial planning (Jentoft & Knol, 2014). An important caveat is that social fit alone may not achieve positive social-ecological outcomes if the ecological fit of governance arrangements is poor.

It is often implicitly assumed that individuals within a particular context experience governance in the same way, yet this study highlights heterogeneous perceptions. Understanding diversity in experiences of governance, for example, through monitoring perceptions, can help managers identify interventions that enhance social fit and help realize potential benefits for conservation. This study finds perceptions of community cohesion may influence those of resource governance, emphasizing the importance of a well-functioning civil society in achieving good governance (Plummer & FitzGibbon, 2006). Coupled with capacity-building frameworks (Robins, 2008), such findings can be useful in designing targeted interventions that complement and enhance individual and community characteristics. Findings underscore the view that developing capacity to support resource governance may require interventions focused on community processes and outlook as well as those that build individual skills and knowledge.

Though calls for improved natural resource governance are ubiquitous, the relationship between the application of good governance principles and the socioeconomic and environmental outcomes of governance remains poorly defined. Social acceptance of institutional arrangements is an important link in this relationship, as community perceptions may influence support for resource management. This large-scale study contributes to an understanding of how institutional acceptance, an important component of social fit, varies among individuals across diverse coral reef governance arrangements in the Caribbean. Though spatially extensive, this study presents a snapshot of individuals' views. These

may change over time, requiring governance arrangements to remain responsive to dynamic perceptions. Further qualitative research would augment this study by identifying values that underpin people's views on governance quality (Song et al., 2013). Nevertheless, findings presented here highlight the need for governance to be tailored to particular groups within communities to improve social fit. In particular, attention is drawn to the strong role played by aspects of community cohesion and social capital, supporting the argument for effective governance processes to invest in measures that strengthen civil society and community solidarity. These insights can support conservation managers to engage effectively in governance processes that increasingly engage a range of actors in decision-making.

ACKNOWLEDGMENTS

We are grateful for the generosity and hospitality of the Caribbean communities who gave their time for interviews, and numerous partners and collaborators in each country who supported the research team. M Phillips, R Ford, S Bonilla, S Brune, K Hogg, S Gardiner, J Pollock, L Chicas, C Guerrero, C Barrow, and C Hinds assisted with data collection and data entry. The research leading to these results has received funding from the European Union 7th Framework Programme (P7/2007-2013) under grant agreement No. 244161. Thanks to two anonymous reviewers whose comments greatly improved this article.

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SUPPORTING INFORMATION

Additional Supporting Information may be found online in the supporting information tab for this article.

How to cite this article: Turner RA, Forster J, Fitzsimmons C, *et al.* Social fit of coral reef governance varies among individuals. *Conserv. Lett.* 2017;00:e12422. <https://doi.org/10.1111/conl.12422>